68. (New) An exposure method according to Claim 66, wherein said interval of said measuring said transmittance is

short when a rate of change in said transmittance of said optical system is large, and

long when said rate of change in said transmittance of said optical system is small.

A1' cont.

REMARKS

Favorable reconsideration of this application is respectfully requested.

An Information Disclosure Statement has been filed to make of record three references.

Claims 1, 4-6, 14-24, 28-35, 40-42, 44-46 and 49-68 are now present in this application, claims 2, 3, 7-13, 25-27, 36-39, 43, 47 and 48 having been canceled and claims 59-68 being added by way of the present amendment. New claims 59-68 are believed to be supported by the specification and thus no question of introduction of new matter is raised. Claims 1-5, 14, 15 and 22-27 stand rejected under 35 USC §102(e) over US 5,861,944 (Nishi) and claims 6-13, 16-21 and 28-58 stand rejected over 35 USC §103(a) over Nishi in view of US 5,721,608 (Taniguchi).

Nishi discloses an exposure apparatus in which a constant illumination intensity mode is used when exposure is performed in a scanning exposure method and a constant power mode is used when alignment is performed. Also, Nishi discloses a structure for measuring unevenness in illumination intensity to measure dispersion in exposure amount within a shot area on a wafer.

Further, Taniguchi discloses a structure for detecting information on a transmittance of a reticle based on an output from a radiation amount sensor 41 and an output from a light

source sensor 28. In Nishi and Taniguchi, however, there is no disclosure or suggestion of the invention as defined by the recited claims.

In claim 1, a measurement interval of the transmittance of the optical system is set to be different depending on exposure conditions, the transmittance is measured at the set measurement interval, and the exposure amount control target is set in accordance with the measured transmittance at the interval. The Office Action refers to column 11, line 60 of Nishi. However, this portion of Nishi refers to the integrated exposure amount at points on the wafer derived from integrating the signal from sensor 11. In other words, one can determine exposure amounts at points on a wafer by integration of the sensor 11 signal, not that an interval between measurements is determined. There is no assertion that Taniguchi suggests such a method. Claim 1 is patentable over Nishi and Taniguchi.

Claim 6 recites that a measurement interval of the transmittance of the optical system is set in accordance with a variation amount of transmittance of the optical system, and the exposure amount control target is set in accordance with the measured transmittance at the interval. This is also not suggested by Nishi. There is no assertion that Taniguchi suggests such a method. Claim 6 is patentable over Nishi and Taniguchi.

The measurement interval is set in accordance with an exposure condition, and a variation in the amount of exposure light which passes through an optical system and reaches a substrate is measured at the interval in claim 14. This is not suggested by either Nishi or Taniguchi. Claim 14 is patentable over Nishi and Taniguchi.

Claim 16 recites changing the measurement interval based upon two measurements of the amount of light measured at the measurement interval. The Office Action does no explain who either of Nishi and Taniguchi suggest such a method. Nishi was not found to suggest such a method, and the description of Taniguchi only refers to irradiating the optical

system and a predictive function. No case of obviousness has been made for claim 16 and allowance of claim 16 is in order.

In claim 19 a time-varying prediction function is determined in consideration of an exposure condition in a self-cleaning operation. Taniguchi state functions to determine E and P, not how to determine a time-varying predictive function, or determining the function based upon exposure conditions of a self-clean step. Allowance of claim 19 is in order.

The measurement interval is set in accordance with an exposure condition, and the amount of exposure light which passes through an optical system and reaches a substrate is measured at the interval in claim 14. This is not suggested by either Nishi or Taniguchi. Claim 14 is patentable over Nishi and Taniguchi.

In the apparatus of claim 24, the control unit sets a measurement interval in accordance with an exposure condition, and the transmittance measurement unit measures transmittance at the interval. There is no measurement interval set based upon an exposure condition in Nishi. Integrating a signal from sensor 11 may produce exposure at points, but no measurement interval is set. Claim 24 is also patentable over Nishi.

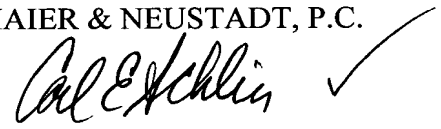
The control unit in the apparatus of claim 29 sets a measurement interval based upon a variation amount between two measurements of transmittance, a most recent and an earlier measurement. Transmittance is measured by a transmittance measurement unit at the interval. Neither Nishi nor Taniguchi suggest using a variation between a most recent and an earlier measurement to set a measurement interval. Allowance of claim 29 is in order.

The systems of claims 42 and 44-46 are also not suggested by the applied prior art. In claim 44 the control unit changes an interval of measurement based upon two measurements. Neither reference suggests changing a measurement interval. In claim 45 the control unit determines a time-varying prediction function based upon a predetermined

condition of exposure. Neither reference determines any function based upon an exposure condition. In claim 46 the measurement unit measures light passing through the optical system and reaching onto the substrate, and a control unit sets a measurement interval of the measurement unit in accordance with an exposure condition. Neither reference suggests this. Allowance of claims 42 and 44-46 is respectfully requested.

It is respectfully submitted that the present application is in condition for allowance and a favorable decision to that effect is respectfully requested.

Respectfully submitted,
OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Gregory J. Maier
Registration No. 25,599
Attorney of Record
Carl E. Schlier
Registration No. 34,426

22850

Phone: (703) 413-3000
Fax No.: (703) 413-2220
GJM/CES/maj
I:\atty\CES\198322US.am1.wpd

Marked-Up Copy
Serial No: 09/680,513
Amendment Filed on: October 11, 2001

IN THE CLAIMS

Please amend the claims as follows:

1. (Amended) An exposure method performed by an exposure apparatus [which has an optical system] to transfer a pattern illuminated with exposure light from a light source onto a substrate, said method comprising:

photodetecting a part of said exposure light in an optical path of said exposure light;

setting a measurement interval of a transmittance of an optical system which is arranged between a position of photodetecting a part of said exposure light and said substrate to be different depending on exposure conditions;

measuring a transmittance of said optical system at said set measurement interval;

setting an exposure amount control target value in accordance with [a] said measured transmittance of said optical system; and

transferring said pattern onto said substrate through said optical system while an exposure amount is controlled based on photodetection results of a part of said exposure light and said set exposure amount control target value.

4. (Amended) An exposure method according to Claim [3] 1, wherein said exposure condition includes a transmittance of a mask.

5. (Amended) An exposure method according to Claim [3] 1, wherein said exposure condition includes one of a minimum line width and a permissible exposure amount error.

6. (Amended) An exposure method performed by an exposure apparatus to transfer a pattern illuminated with exposure light from a light source onto a substrate, said method comprising:

photodetecting a part of said exposure light in an optical path of said exposure light;

setting a measurement interval of a transmittance of said optical system which is arranged between a position of photodetecting a part of said exposure light and said substrate in accordance with a variation amount of transmittance of said optical system;

setting an exposure amount control target value in accordance with said measured transmittance of said optical system at said set measurement interval; and

transferring said pattern onto said substrate through said optical system while an exposure amount is controlled based on photodetection results of a part of said exposure light and said set exposure amount control target value

[An exposure method according to Claim 2, wherein said measurement interval is changed in accordance with a variation amount between a transmittance obtained by a most recent transmittance measurement and a transmittance obtained by a measurement performed before said most recent measurement].

14. (Amended) An exposure method to transfer a pattern illuminated with exposure light from a light source onto a substrate through an optical system, said method comprising:

setting a measurement [intervals] interval in accordance with an exposure condition; and

measuring a variation in the amount of said exposure light [passing] which passes through said optical system and reaches onto said substrate at [in] said set measurement [intervals]

interval.

22. (Amended) An exposure method to transfer a pattern illuminated [from a light source] with exposure light from a light source through an optical system onto a substrate, said method comprising:

setting a measurement interval in accordance with an exposure condition; and

measuring an amount of said exposure light [passing] which passes through said optical system and reaches onto said substrate at [in] said measurement interval.

24. (Amended) An exposure apparatus to transfer a pattern illuminated with exposure light from a light source onto a substrate [through an optical system], said exposure apparatus comprising:

a branch optical system arranged in an optical path of said exposure light to branch a part of said exposure light;

an optical system arranged between said branch optical system and said substrate;

a transmittance measurement unit to measure a transmittance of said optical system;

a control unit connected with said transmittance measurement unit to set a measurement interval of said transmittance measurement unit in accordance with an exposure condition;

an exposure amount setting unit connected with said transmittance measurement unit to set an exposure amount control target value in accordance with said measured [a] transmittance of said optical system; and

an exposure amount control system connected with said exposure amount setting unit to control an exposure amount based on said set exposure amount control target value;

wherein

said transmittance measurement unit measures a transmittance of said optical system at said set measurement interval.

28. (Amended) An exposure apparatus according to Claim [27] 24, further comprising:

an information reading unit to read information of a mask on which the pattern is formed, and

said control unit automatically determines measurement intervals for said transmittance measurement unit based on said information of said mask read by said information reading unit.

28. (Amended) An exposure apparatus to transfer a pattern illuminated with exposure light from a light source onto a substrate, [according to Claim 26, further] said exposure apparatus comprising:

a branch optical system arranged in an optical path of said exposure light to branch a part of said exposure light;

an optical system arranged between said branch optical system and said substrate;

a transmittance measurement unit to measure a transmittance of said optical system;

a control unit connected with said transmittance measurement unit to set [said] a transmittance measurement interval of said transmittance measurement unit in accordance with a variation amount between a transmittance obtained by a most recent transmittance measurement and a transmittance obtained by a measurement performed before said most recent measurement, said respective measurement performed by said transmittance measurement unit;

an exposure amount setting unit connected with said transmittance measurement unit to set an exposure amount control target value in accordance with said measured transmittance of said optical system; and

an exposure amount control system connected with said exposure amount setting unit to control an exposure amount based on said set exposure amount control target value; wherein

said transmittance measurement unit measures a transmittance of said optical system at

said set measurement interval.

32. (Amended) An exposure apparatus according to Claim [25] 29, [wherein said transmittance measurement unit includes] further comprising:

a first sensor to photodetect a part of said exposure light, said first sensor being arranged in the optical path of a part of said exposure light branched by said branch optical system, and

a second sensor arranged to be substantially flush with said substrate to photodetect said exposure light passing through said optical system; wherein

said transmittance measurement unit includes

a control unit to obtain a transmittance of said optical system, based on an output signal which said first sensor outputs by photodetecting a part of said exposure light and an output signal which said second sensor outputs by photodetecting said exposure light passing through said optical system

[a first optical sensor disposed in a light path of said exposure light to detect said amount of exposure light irradiated on said pattern,

a second optical sensor arranged to be substantially flush with the substrate, and

a control unit connected with said first optical sensor and said second optical sensor to detect said amount of exposure light passing through said optical system by using said second optical sensor at a timing which corresponds to an exposure condition, and to obtain a transmittance of said optical system based on said amount of exposure light and an output from said first optical sensor].

34. (Amended) An exposure apparatus according to Claim [32] 24, wherein said control unit sets a measurement interval of said transmittance measurement unit in accordance with [detects said amount of exposure light having passed through said optical system at a timing which corresponds to] a transmittance of said mask on which said pattern is formed.

35. (Amended) An exposure apparatus according to [Claim 32] Claim 24, wherein said control unit sets a measurement interval of said transmittance measurement unit in accordance with [detects said amount of exposure light having passed through said optical system at a timing set in consideration of] one of a minimum line width and a permissible exposure amount error.

42. (Amended) An exposure apparatus to transfer a pattern illuminated with exposure light from a light source onto a substrate [through an optical system], said exposure apparatus comprising:

a branch optical system arranged in an optical path of said exposure light to branch a part of said exposure light;

an optical system arranged between said branch optical system and said substrate;

a first sensor arranged in the optical path of a part of said branched exposure light to photodetect a part of said exposure light;

a second sensor arranged substantially flush with said substrate to photodetect said exposure light passing through said optical system;

a measurement unit connected with said first sensor and said second sensor to measure a variation in an amount of exposure light passing through said optical system, based on an output signal from said first sensor and an output signal from said second sensor; and

a control unit connected with said measurement unit to change an interval [intervals] of [said] a measurement performed by said measurement unit in accordance with an exposure condition.

46. (Amended) An exposure apparatus to transfer a pattern illuminated with exposure light from a light source onto a substrate through an optical system, said exposure apparatus comprising:

a measurement unit to measure an amount of exposure light passing through said optical system and reaching onto said substrate at a predetermined interval; and

a control unit connected with said measurement unit to set said interval of a measurement performed by said measurement unit in accordance with an exposure condition.